The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

Assessment Number **BTC 16318LC**

A STRUCTURAL LETTER OF CONFORMITY FOR ESTIMATION OF THE BS 5234 DUTY RATING OF A BRITISH GYPSUM GYPWALL PARTITION CLAD WITH DOUBLE LAYER OF 15mm GYPROC SOUNDBLOC AND INCORPORATING GYPFRAME 92S50 STUDS

Assessment Date: 1st May 2009

www.btconline.co.uk

Applicant: **British Gypsum**
East Leake
Loughborough
Leicestershire
LE12 6HX

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

TABLE OF CONTENTS

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

DETAILS OF THE REQUEST

It is required to assess the following construction for structural performance if tested in accordance with BS 5234: Part 2: 1992 Annexes A, B, C, D, E & F on behalf of British Gypsum.

General partition description

A 4.5m (long) Gypwall partition constructed in the test aperture with one end of the partition fixed to the test rig and the other remaining free.

A door set, measuring 900mm x 2100mm is incorporated into the partition 700mm from the fixed end.

Framework

Gypframe 94C50 Standard Floor and Ceiling Channels screw fixed at 600mm centres to the head and base of the test aperture.

Gypframe 92S50 'C' Studs positioned at either end of the head and base channel, one screw fixed to one side of the test aperture at 600mm centres; the other end remaining free.

Gypframe 92S50 studs positioned between the head and base channel at 600mm centres.

Door Aperture

The vertical framework at the door opening formed using Gypframe 92S50 studs.

At the base, Gypframe 94C50 Standard Floor and Ceiling Channel extended 300mm beyond the door opening on either side, with the 300mm extension bent up through 90° to cover the bottom of the jamb stud and fixed twice either side using 13mm Gyproc wafer head screws.

At the head, Gypframe 94C50 Standard Floor and Ceiling Channel cut and bent to extend 150mm down the face of the studs, and fixed twice to each side using 13mm Gyproc wafer head screws.

The door jambs sleeved to full door height with Gypframe 94C50 Standard Floor and Ceiling Channel.

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

Cladding

The framework clad with a double layer of 15mm Gyproc SoundBloc on each side of the partition.

The inner layer of boards screw fixed around the perimeter of the board at 300mm centres using 32mm Gyproc drywall screws.

The outer layer of boards screw fixed around the perimeter of the board and the intermediate stud positions at 300mm centres using 42mm Gyproc drywall screws.

Joints

All vertical board joints staggered.

The vertical and horizontal joints adjacent to the door are taped and filled on both sides using Gyproc Joint Tape and Gyproc Joint Filler.

Door Frame, architrave and skirting

The door frame fixed into position using two 60mm Gyproc Drywall screws at each point 150mm from the bottom of the casing and at 600mm centres thereafter.

A softwood architrave fixed to both sides of the partition into the timber door frame.

Softwood skirting fixed to both sides of the partition.

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

THE ASSESSORS

The Building Test Centre operates as an independent accredited test house for the construction industry. The Building Test Centre has unrivalled experience in the development of drywall systems. The Building Test Centre is UKAS accredited under No. 0296 for fire resistance, reaction to fire, acoustic and structural testing. The Building Test Centre is wholly owned by British Gypsum a major manufacturer of building products.

ASSESSMENT AUTHORISATION

Assessment Author	Reviewing Assessor
Martin Lynch *Technologist*	pp **Phil Barnes pp Alexandra Ahern** *BTC Test Manager*

This assessment is not valid unless it incorporates the Declaration by Applicant form duly signed by the applicant.

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

TEST EVIDENCE

The test evidence used in this assessment has been used under the authorisation of the test report owner and has been used with their permission (see pages 16 & 17). Furthermore, the test evidence has been reviewed by The Building Test Centre to ensure that the test reports are still valid.

BTC 1227S

Structural performance tests to BS 5234: PART 2: 1992 on a 122mm double layer Gyproc metal stud (70S50) partition, 6.0m high

Description
The partition specimen was erected in a straight run 4.5m long x 6.0m high with one fixed end and one free end. The specimen included a door set positioned 700mm from the fixed end. 70S50 Gyproc metal studs set at 600mm centres into Gyproc 72C50 head and base channel. Two layers of 12.5mm x 1200mm x 2400mm Gyproc WallBoard each side (board code 26-173-3), vertical joints staggered between layers and from side to side. Inner layer fixed with 25mm Gyproc drywall screws at 300mm centres around perimeter of the boards, outer layer fixed with 36mm Gyproc drywall screws at 300mm centres around the perimeter of the boards and at intermediate stud positions. Gyproc fixing strap fitted between boards at outer layer horizontal joints.

Framing at door opening.
70S50 studs (one 2700mm and one 1300mm long) cloaked with 72EDC90 to full height. 72EDC90 fixed to 70S50 studs with three pop rivets into each flange. A foot formed at the base of each jamb by cutting the flanges of the 72EDC90, 300mm in from one end and bending the 72EDC90 through 90° with the flanges of the 300mm foot over the flanges of the jamb. The 300mm foot fixed to the floor with two screws at each end. A Gyproc soffit cleat fixed each side of the 300mm foot at the door jamb end with the 25mm flange fixed to the floor with one 38mm x No. 12 woodscrew and the 35mm flange fixed with one Gyproc wafer head screw through the flange of the 72EDC90 and into the flange of the 70S50.

Door casing fixed using two self tapping No. 12 screws at each point 150mm from the bottom of the casing and 600mm centres thereafter. **Note the door casing was fitted without the use of packing material.**

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

The tested construction for BTC 1227S achieved the following result:

SUMMARY OF TESTS FOR GRADE COMPLIANCE					
Summary of Strength and Robustness of a specimen tested to BS 5234: Part 2: 1992					
Requirement Tested	Test method annex	Grade Performance achieved Pass/Fail			
		LD	MD	HD	SD
Stiffness	A				Pass
Surface damage by small hard body impact:# Straight partition	B				Tested
Resistance to damage by large soft body impact Straight partition	C				Pass
Perforation by small hard body impact Straight partition	D				Pass
Resistance to structural damage by large soft body impact	E				Pass
Door slamming	F				Pass
GRADE ACHIEVED					Pass
# As this is indicative (without pass or fail criteria) the term "tested" is shown against the appropriate level of performance. Sponsors and specifiers should ascertain if surface damage is acceptable.					

The test was carried out in accordance with BS 5234: Part 2: 1992 Annexes A, B, C, D, E, and F. The test was carried out between the 28th and 30th September 1993 at the Building Test Centre. The test was carried out on behalf of British Gypsum.

Applicant: British Gypsum

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

BTC 11191S

A structural test conducted to BS 5234: PART 2: 1992, Annexes A - G on a 4.2m high Gyproc Gypwall Robust partition system incorporating Gyproc 70S70 studs at 600mm centres and single layer 13mm Gyproc DuraLine XL board each side

The partition specimen was erected in a straight run 4750mm long x 4200mm high with one fixed end and one free end. The specimen included a doorset, incorporating a door of 60kg nominal weight, positioned 700mm from the fixed end (see figure 1).

Gyproc 72C50 channel was screw fixed to the head and base of the test rig at 600mm centres. Gyproc 70S70 studs were positioned between the head and base channels at 600mm centres with a 70S70 stud at the fixed end.

To frame the door opening, Gyproc 70S70 studs were fixed either side of the opening. At the base, the 72C50 channels were extended 300mm beyond the door opening, and each flange of the extended channel was cut at the jamb position. The 300mm over run was bent through 90° to cover the bottom of the jamb stud and fixed twice either side using 13mm Gyproc wafer head screws. The head track for the door frame was formed from a Gyproc 72C50 channel which was cut and folded down to sleeve the door jamb studs. The remainder of the door jamb was sleeved using Gyproc 72C50 channel which was crimped at 600mm centres. Four additional fixings of 38mm No. 10 round head woodscrews were made at the base of the door jambs and at 150mm from the opening. Intermediate studs were placed centrally above the door and 150mm from the door closing jamb edge for taking the board edges.

The door casing was fixed with two 75mm Gyproc S point screws at each point 150mm from the base and continued at 600mm centres.

A single layer of 13mm Gyproc Duraline XL board was screw fixed either side of the framework around the perimeter and within the field of the board at 300mm centres to all metal members using 25mm Gyproc jack point screws. The metal was boarded so that no vertical joint fell in line with the door closing jamb stud. A horizontal fixing strap was fixed behind the horizontal joint at a height of 2400mm from the base of the partition.

Joints around the door frame were taped, jointed and architrave and skirting were fixed.

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

Gyproc Duraline XL Board

Nominally, 2400mm (long) x 1200mm (wide) x 13mm (thick), Gyproc Duraline XL board made by British Gypsum, ex Kirkby Thore works.

Surface density:	11.84kg/m^2
Actual thickness:	13.7mm
Board code:	27-039-0 18:52

The board thickness is the mean thickness of the boards used for the test specimen.

The tested construction for BTC 11191S achieved the following result:

SUMMARY OF TESTS FOR GRADE COMPLIANCE					
Requirement Tested	Test Annex	Grade Performance achieved Pass/Fail			
		LD	MD	HD	SD
Door slamming	F			Pass	
GRADE ACHIEVED	HEAVY				

The test was carried out in accordance with BS 5234: Part 2: 1992 Annexes A, B, C, D, E, and F. The test was carried out between the 28th and 29th September 1993 at the Building Test Centre. The test was carried out on behalf of British Gypsum.

Applicant: British Gypsum

The Building Test Centre
Fire Acoustics Structures

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

BTC 095LC

Estimating the recommended maximum heights of British Gypsum partitions and linings lined with various lining materials

THE PREDICTION METHOD (GYPWALL METAL STUD PARTITIONS)

The partition stiffness is calculated from the addition of the metal stud frame stiffness and the board stiffness contribution.

The metal stud frame stiffness is calculated from the simple bending of the stud in the absence of non-linear effects and based on the second moment of area. This approach is used because the stud is constrained by the boards each side to bend about its central axis and the amount of movement is only 0.4% (i.e. L/240). The number of studs per metre is taken into account. The slight weakening effect of stud cut-outs is ignored here as is splicing but is counted within the board stiffness contribution.

	STUD SPACING mm					
STUD	600	600 Boxed	400	400 Boxed	300	300 Boxed
48S50	9.25	12.7	13.9	19	18.5	25.4
48I55	18.2		27.3		36.4	
60S55	16.6	22.7	24.9	34.1	33.2	45.4
60S70	21.1	28.9	31.7	43.4	41.2	57.8
60I55	29.1		43.7		58.2	
60I70	37		55.5		74	
70S50	21.2	29	31.8	43.6	42.4	58
70S70	29.7	40.7	44.6	61	59.4	81.4
70I70	51.4		77.1		102.8	
92S55	43.2	59.2	64.8	88.8	86.4	118.4
92S12	94.3	129.2	141.4	193.8	188.6	258.4
92I90	118.9		178.4		237.8	
146S50	115.3	158	173	236.9	230.6	316
146S55	126.8	173.7	190.2	260.6	253.6	347.4
146S70	161.4	221.1	242.1	331.7	322.8	442.2
146TI90	328.8		493.2		657.8	
43I50	8.8 (900cs)					

Table 1. Stud frame stiffness contributions x 10^9Nmm^2

This letter of conformity was conducted on behalf of British Gypsum, last updated 19th February 1997.

Applicant: British Gypsum

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

Sectional Properties for Studwork

British Gypsum Gypframe 70S50

Second Moment of area (gross or unreduced) for major axis bending:

Ixx = 5.59 cm^4

British Gypsum Gypframe 92S50

Second Moment of area (gross or unreduced) for major axis bending:

Ixx = 10.84 cm^4

From inspection of DETAILS OF THE REQUEST and the sectional properties of the Gypframe 92S50 stud the EI of the partition can be estimated by:

Stud Stiffness Contribution (using Youngs Modulus of Elasticity for steel = 2.05 $kNmm^2$):

$$EI = \frac{EI_{xx}}{c/c} = \frac{2.05 \times 10.84}{0.6}$$

Where c/c is the stud centres.

Stud Stiffness Contribution EI = 37 x 10^9 Nmm^2

Evidence provided by British Gypsum on 3rd April 2009

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

DISCUSSION

With non-loadbearing lightweight steel stud constructions, the structural duty rating performance is governed by the surface density (mass) of the face linings, the number of board layers and the structural properties of the framework.

The system described in the DETAILS OF THE REQUEST have not been subjected to a partition grade test in accordance with BS 5234: Part 2 : 1992.

The three Annexes of BS 5234:Part2: 1992 which are determining factors in the partition duty grade achieved by a metal stud partition system are:

- Annex A – Determination of partition stiffness
- Annex D – Resistance to perforation by a small hard body impact
- Annex F – Determination of the effects of door slamming

The only changes to the construction detailed under DETAILS OF THE REQUEST compared to BTC 1227S is:

Partition element	Comment on differences between DETAILS OF THE REQUEST and Primary Evidence
Channel	Increase in cavity size of metal work from 72mm to 94 mm
Studs	Increase in cavity size of metal work from 70mm to 92mm
Detail of metalwork at door	Old heavy/severe duty door detail description replaced with current version in line with current BG recommendation in White Book
Cladding	12.5mm Gyproc WallBoard replaced with Gyproc SoundBloc and increase of thickness to 15mm
Performance	Primary evidence achieved the desired SEVERE Duty performance in all tested annexes.

Taking each of the determining factors described above in turn and considering secondary evidence:

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

Annex A – Determination of partition stiffness

Primary evidence: BTC 1227S
The test performance for this annex achieved the desired SEVERE Duty however there are changes required in both the metal work and cladding. In changing the cladding configuration, the performance would be enhanced due to the increased density of the board and the fact that the manufacturing process for Gyproc SoundBloc incorporates glass fibres in the core of the board.

Secondary evidence: Stud Sectional Properties
Comparison shows that the 92mm stud required under DETAILS OF THE REQUEST is stiffer than the the 70S50 stud used in the primary evidence. Therefore the partition stiffness should match and/or exceed the desired performance which was achieved by the primary evidence.

Annex D – Resistance to perforation by a small hard body impact

The hard body impact performance of a metal stud partition is a function of the board lining and in extreme cases the stiffness of the stud section. In the proposed case it is reasonable to assume that the differences in cladding will determine the Annex D performance

Primary evidence: BTC 1227S
The test performance for this annex achieved the desired SEVERE Duty however there are changes required in the cladding. In changing the cladding configuration, the performance would be enhanced due to the increased thickness and density of the board.

Annex F
The door slam test is mainly dependent on the detail of the framework around the door aperture. The requirements of the DETAILS OF THE REQUEST are taken from the current specification given by British Gypsum in the White Book for Heavy/Severe Duty Door Detail

Primary evidence: BTC 1227S
The test performance for this annex achieved the desired SEVERE Duty however there are changes required to the door framing detail.

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

Secondary evidence: BTC 11191S, BTC 095LC and Stud Sectional Properties

Partition element	Differences in Secondary Evidence compared to Primary Evidence	Comment for assessment
Studs	Slightly thicker studs used in BTC 11191S compared to primary evidence. Inspection of BTC 095LC shows that the stud frame stiffness contribution is likely to be greater using 70S70 compared to the 70S50 in the primary evidence	The specification required by DETAILS OF THE REQUEST would provide greater stud frame stiffness than BTC 11191S as from inspection of calculations on page 11 we can see that the stud stiffness contribution for Gypframe 92S50 studs is expected to be in the region of 37 x 10 $^{9}Nmm^{2}$ as opposed to 30 x10 $^{9}Nmm^{2}$ for Gypframe 70S70 studs. Although the door frame fixings into the metalwork for the 92S50 studs may be slightly less secure than the 70S70 studs due to the reduction in thickness of metalwork, this fixing detail was sufficient when using 70S50 studs in the primary evidence
Performance	BTC 11191S achieved Heavy/Severe Duty performance for the Annex F test	This meets the performance desired by DETAILS OF REQUEST

From the evidence above, it can be concluded that the construction described under DETAILS OF THE REQUEST would be likely to achieve a minimum duty rating of SEVERE if the partition was tested in accordance with BS 5234: Part 2: 1992 Annexes A, B, C, D, E & F.

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

CONCLUSION

In view of the foregoing evidence, it is our opinion that if the construction described under DETAILS OF THE REQUEST were subjected to a structural test, in accordance with BS 5234: Part 2: 1992 Annexes A, B, C, D, E & F, it would achieve the following performance:

Estimated Classification grade awarded to this partition system : SEVERE duty

LIMITATIONS

This assessment addresses itself solely to the ability of the partition system described to satisfy the criteria of the structural test and does not imply any suitability for use with respect to other unspecified criteria.

This assessment is issued on the basis of test data and information to hand at the time of issue. If contradictory evidence becomes available to the assessing authority the assessment will be unconditionally withdrawn and the applicant will be notified in writing. Similarly the assessment is invalidated if the assessed construction is subsequently tested since actual test data is deemed to take precedence over an expressed opinion. The assessment is valid initially for a period of five years after which time it is recommended that it be submitted to the assessing authority for re-appraisal. The opinions and interpretations expressed in this assessment are outside the scope of UKAS accreditation.

The Building Test Centre
Fire Acoustics Structures

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

DECLARATION BY THE APPLICANT

We confirm that the component or element of structure, which is the subject of this assessment, has not to our knowledge been subjected to a structural test to the Standard against which this assessment is being made.

We agree to withdraw this assessment from circulation should the component or element of structure be subjected to a structural test to the Standard against which this assessment is being made.

We are not aware of any information that could adversely affect the conclusion of this assessment.

If we subsequently become aware of any such information we agree to ask the assessing authority to withdraw the assessment.

Signed: ..... Print Name JONATHAN YOUNG

For and behalf of British Gypsum.

The Building Test Centre
Fire Acoustics Structures

The Building Test Centre
British Gypsum
East Leake
Loughborough
Leics. LE12 6NP
Tel (0115) 945 1564
Fax (0115) 945 1562
email btc.testing@bpb.com

AUTHORITY FOR USE OF TEST EVIDENCE

Test Report Numbers: BTC 1227S, BTC 11191S, BTC 095LC

We the undersigned agree to the above Test Reports being used as supporting evidence for the following assessment:

A structural letter of conformity for estimation of the BS 5234 duty rating of a British Gypsum Gypwall partition clad with a double layer of 15mm Gyproc SoundBloc and incorporating Gypframe 92S50 studs

Assessment client: British Gypsum

Signed: ..... Print Name: JONATHAN YOUNG

Job Title: PLASTERBOARD TECHNOLOGIST

Department: TECHNICAL

For and behalf of **British Gypsum**